This is a digital copy of a book that was preserved for generations on library shelves before it was carefully scanned by Google as part of a project to make the world's books discoverable online.

It has survived long enough for the copyright to expire and the book to enter the public domain. A public domain book is one that was never subject to copyright or whose legal copyright term has expired. Whether a book is in the public domain may vary country to country. Public domain books are our gateways to the past, representing a wealth of history, culture and knowledge that's often difficult to discover.

Marks, notations and other marginalia present in the original volume will appear in this file - a reminder of this book's long journey from the publisher to a library and finally to you.

Usage guidelines

Google is proud to partner with libraries to digitize public domain materials and make them widely accessible. Public domain books belong to the public and we are merely their custodians. Nevertheless, this work is expensive, so in order to keep providing this resource, we have taken steps to prevent abuse by commercial parties, including placing technical restrictions on automated querying.

We also ask that you:

+ *Make non-commercial use of the files* We designed Google Book Search for use by individuals, and we request that you use these files for personal, non-commercial purposes.

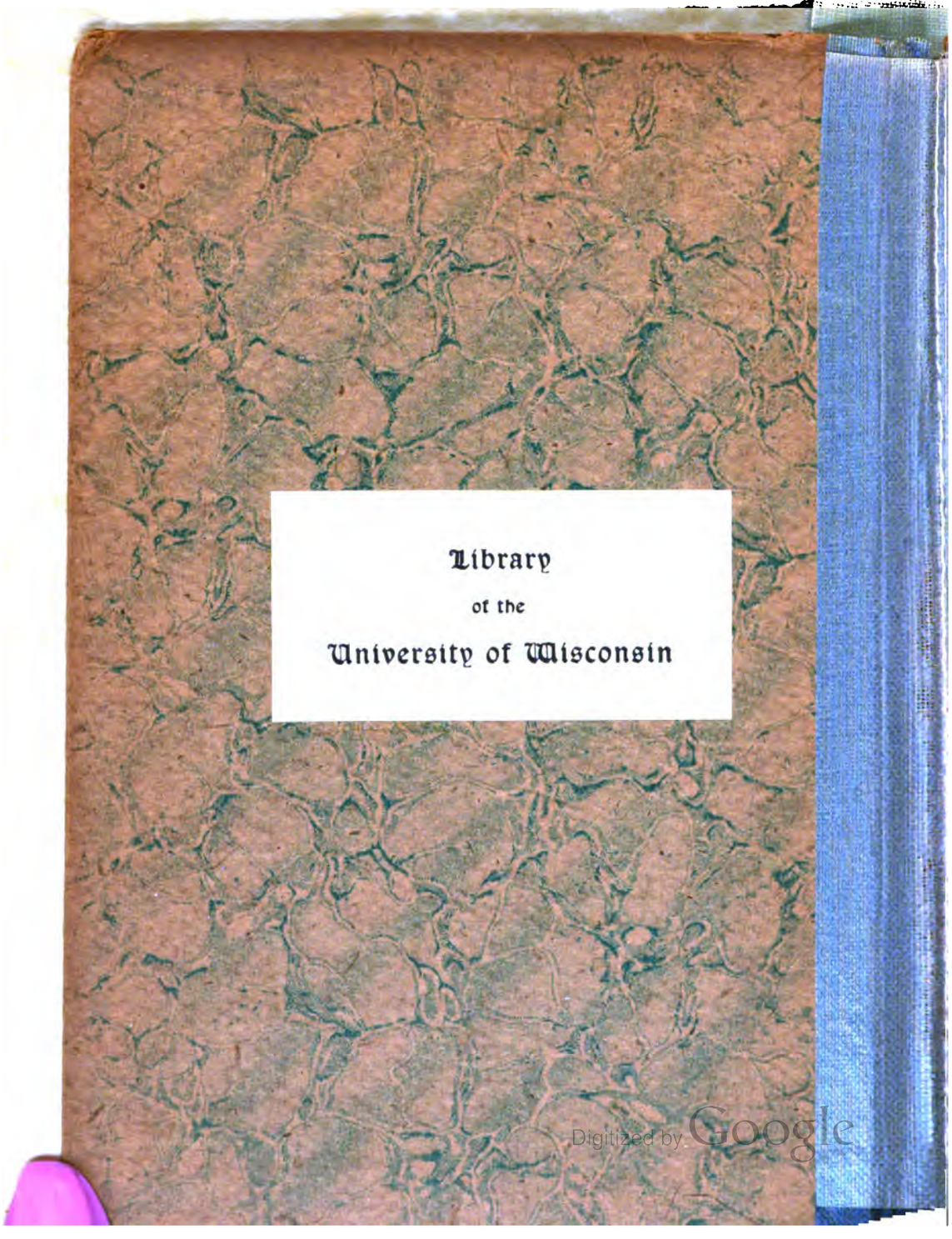
+ *Refrain from automated querying* Do not send automated queries of any sort to Google's system: If you are conducting research on machine translation, optical character recognition or other areas where access to a large amount of text is helpful, please contact us. We encourage the use of public domain materials for these purposes and may be able to help.

+ *Maintain attribution* The Google "watermark" you see on each file is essential for informing people about this project and helping them find additional materials through Google Book Search. Please do not remove it.

+ *Keep it legal* Whatever your use, remember that you are responsible for ensuring that what you are doing is legal. Do not assume that just because we believe a book is in the public domain for users in the United States, that the work is also in the public domain for users in other countries. Whether a book is still in copyright varies from country to country, and we can't offer guidance on whether any specific use of any specific book is allowed. Please do not assume that a book's appearance in Google Book Search means it can be used in any manner anywhere in the world. Copyright infringement liability can be quite severe.

About Google Book Search

Google's mission is to organize the world's information and to make it universally accessible and useful. Google Book Search helps readers discover the world's books while helping authors and publishers reach new audiences. You can search through the full text of this book on the web at `http://books.google.com/`


Library
of the
University of Wisconsin
Digitized by Google

SS
K63
Sup
1

THE BAKER VALVE GEAR

Supplement to

KIRKMAN'S

SCIENCE OF RAILWAYS

CHICAGO
CROPLEY PHILLIPS COMPANY
1914

Digitized by Google

Copyrighted By
CROPLEY PHILLIPS COMPANY
1914

All Rights Reserved

Digitized by Google

194022
APR 22 1915

6379953

The Baker Valve Gear*

The Baker Valve Gear, which is an improvement over what was known as the Baker-Pilliod Valve Gear, is an outside radial gear, i. e., it has no links or sliding blocks. The movement is derived from the crosshead and the eccentric crank. The crosshead moves the valve the amount of the lap and lead each way, and the eccentric crank gives the remainder of the movement. In the short cut-offs the actual effect of the eccentric crank is reduced, while the crosshead movement is constant.

The bearings are all pins and bushings, the latter being ground inside and out to a standard gauge. The pins are case-hardened and ground to size on both the bearing and tapers.

The improved gear has ten per engine less bearings than the old one and the movement of nearly all has been greatly reduced. Three bearings or joints on each side of the engine, aside from the reach-rod, move when the reverse lever is changed.

No loose oil cups are employed; each bearing has an oil reservoir or cup which is made integral with the part. These cavities can be filled with waste or curled hair to retain the oil, obviating the danger of a bearing running dry on the longest runs. All these bearing pins and bolts are exposed to view so that they can be got at

* "We are well pleased with the manner in which you have covered our valve gear."—Ross Graham, Mechanical Engineer, The Pilliod Company, Swanton, Ohio.

Digitized by Google

to be removed by the engineman or repairman. Three pins, or two pins and a bolt, remove the hardest piece to be taken down. The heaviest piece, the bell crank, weighs only 86 pounds.

Standardization of Parts—This has been reached to some extent in the Baker Gear as all the outside admission gears of this make are alike and all the inside gears are the same, no matter what the type or class of engine upon which used. The yokes and radius bars are also the same for both admissions. The combination lever must suit the stroke of the engine and the lap and lead. Since there is not enough difference in the power it takes to operate a valve on the different modern engines it does not warrant different sized gears. With other gears there is not much, if any, difference in the cross-section area of the same part on the different engines. All parts are interchangeable, and the castings, including the frame, are the same for both sides of the engine except the gear connection rod. The combination lever has rights and lefts, but they are drop-forged.

The frame is one piece cast steel, the same casting on both sides of the engine; one type for inside admission and another type for outside admission. The frame is designed with an extension so that the same frame will go on a variety of engines. This reduces to the minimum the number of kinds of frames that any road may have. So far two designs of outside and one design of inside admission frame have been used. Fig. 1 shows a general view of the gear.

Digitized by Google

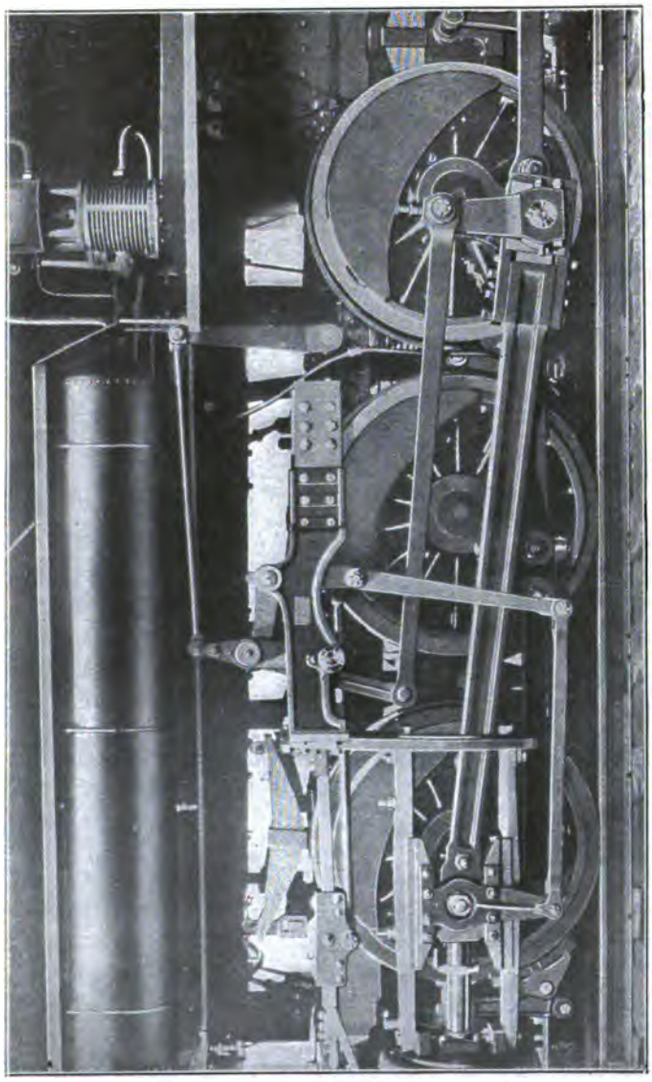


Fig. 1

Digitized by Google

Alignment—Every part of the gear is symmetrical with respect to the center line of the gear, and all pins are supported on each end. This makes a straight line motion, and prevents the possibility of a twisting effect on any part. This construction is claimed to increase the strength of the gear and also the wearing quality of the bearings.

Lead and Preadmission—The Baker Gear has a constant lead with a variable preadmission. The objections to a constant lead have been that it retarded the engine while running in full gear and did not give compression enough in the short cut-offs.

It makes no difference what lead there is in full gear so long as there is not preadmission which is the factor in compression. In full cut-off the Baker Gear has practically no preadmission and the indicator cards show a low compression line. This means a "quick" engine.

As the cut-off is shortened, the preadmission increases, and at 25 per cent there is from ¾-inch to ⅞-inch preadmission.

Fig. 2 shows in a general way the action of the Baker Gear for outside admission. On an inside admission gear the bell crank stands ahead of the reverse yoke and point L for the connection of the valve rod is below point K instead of above. The eccentric crank follows in both cases.

The circle AD is the path of the crank pin. Circle BB′ is the eccentric crank circle. ADX is

Digitized by Google

Fig. 2

Digitized by Google

the main rod. DX is the crosshead. DXN is the crosshead arm. MN is the union link. MKL the combination lever. KJG the bell crank. The gear connection rod is GEC. EF shows the radius bar. HI is the reversing yoke.

The two movements of the gear are as follows: One from the eccentric crank B which follows the main pin at about 90 degrees. The other motion from the crosshead through the combination lever. The eccentric crank moves the radius bar and the action the radius bar has on the valve is controlled by the reverse yoke. The radius bar and yoke take the place of the link and block of a link motion. The combination lever throws the valve the amount of the lap and lead, the same as in the Walschaerts Gear. This makes the lead constant and independent of the cut-off. Having a constant lead the valve should show lead opening in all cut-offs when the engine is on either dead center.

The cut-off, release and compression is done by means of the eccentric crank and controlled by the reversing yoke. The yoke controls the length of the cut-off and also reverses the engine. The action is as follows: Eccentric crank in going from B′ to B moves point C from C'_{-1} to C''_{-1}. By this movement it moves pin E'_{-1} through H to E''_{-1}. The particular path of E is an arc whose radius is $E'_{-1}F_{-1}$. Thus it will be seen that EF causes point E to raise. This rising movement moves G from G_{-4} to G_{-1} which, by means of the bell crank, moves K from K_{-4} to K_{-1}. This it can be seen will move the

Digitized by Google

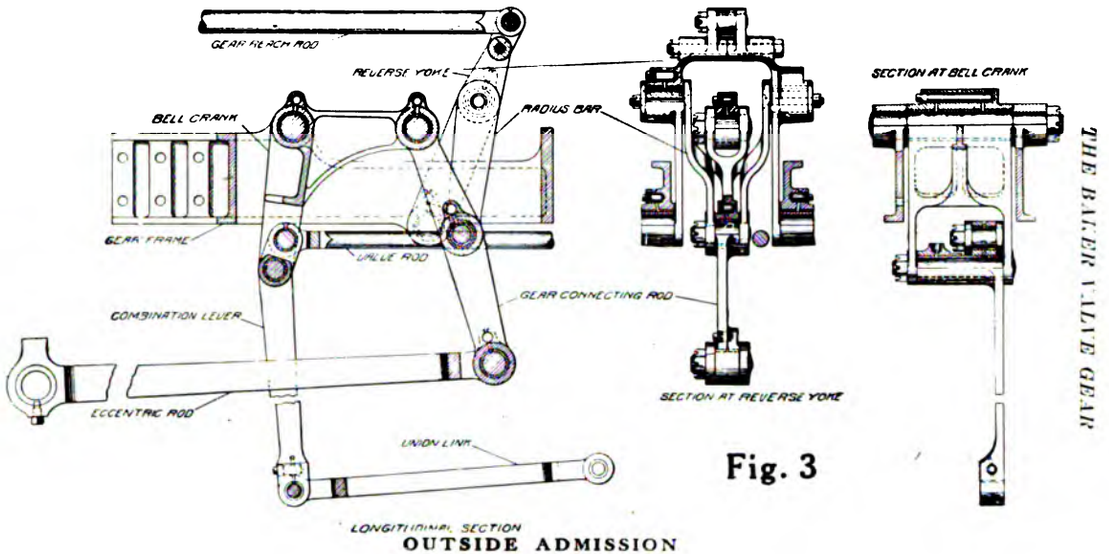


Fig. 3

OUTSIDE ADMISSION

Digitized by Google

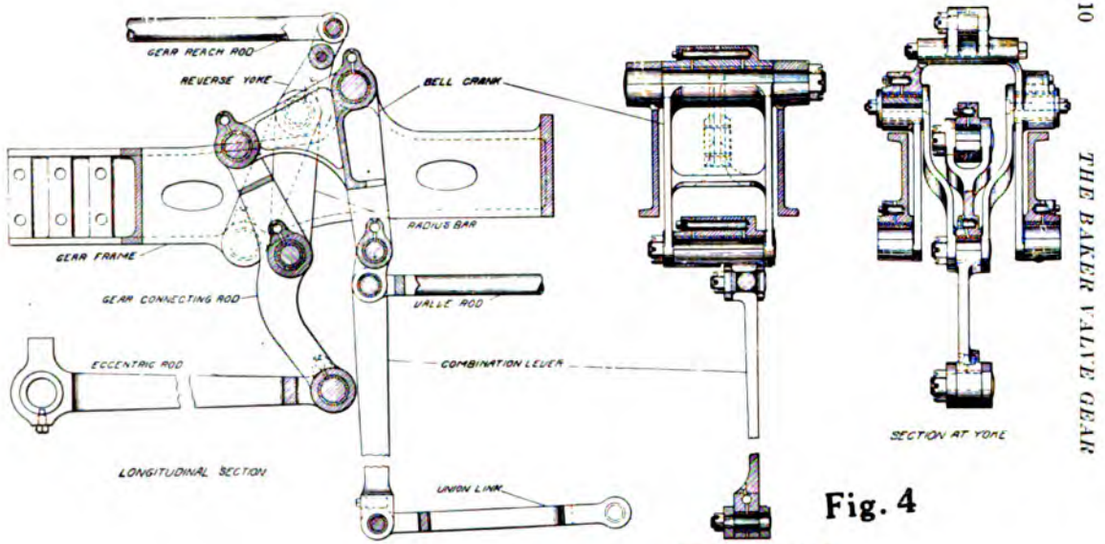


Fig. 4

INSIDE ADMISSION

Digitized by Google

valve forward. The valve is moved backward to its original position in the next half turn of the wheel. The peculiar action of the combination lever is not shown. As the combination lever does its important work near the dead center of the engine and when the engine is in the position as shown in the diagram the combination lever is as shown on the diagram.

From the diagram it will be noticed that E has a rising and falling movement caused by the radius bar EF. If the yoke is changed from I_1 to I_{-2} it would change the center of the radius F. So that E will move from E'_{-2} to E''_{-2} in other words, the rising and falling movement is cut down which would move G from G_{-3} to G_{-2} and K from K_{-3} to K_{-2}. Thus it will be seen that with the varying position of the yoke I the amount of movement of the valve varies. When I is in the mid-gear position E would not move up and down at all but simply swing back and forth in an arc. If I is put in full backward motion the same motion of the eccentric crank that caused the rising movement before would cause the falling movement in the back motion and E would go from E''_{-4} to E'_{-4}. The full motion backward is shown by a dotted line and the short cut-off in backward motion by dash and three dots.

Instructions on Setting the Baker Gear—Connect up the gear and check the throw of the reverse yoke, also clearance at all points, with the eccentric crank clamped temporarily to the main pin, but as near as possible to the specified throw.

Digitized by Google

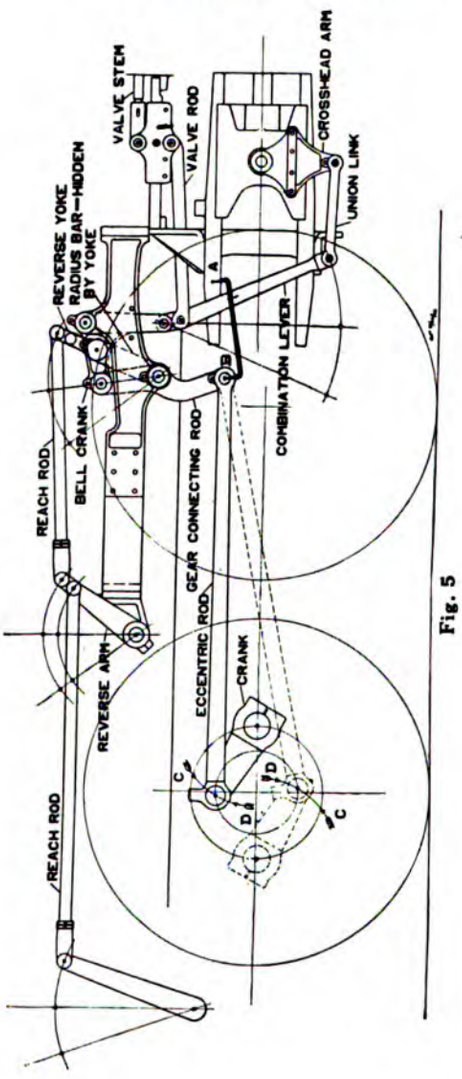


Fig. 5

Digitized by Google

Locate the dead centers in the usual way.

Eccentric Crank—With the engine on the front dead center tram from the center of the pin in front end of eccentric rod to any stationary point, such as the guide yoke or guides, as shown by tram points "A" and "B," Fig. 5. (In most cases the wheel tram can be used for this work.) After scribing a line across the side of the main guide with the "A" end of the tram, revolve the wheel to the back dead center and scribe the guide again; if these two lines are together the crank setting is correct. If they are not, knock the eccentric crank in or out until they do. The position of the reverse lever is not important while finding the eccentric positions. After the valve setter has had sufficient experience, the location of the eccentric can be determined while obtaining the dead centers.

Valve Travel—Put the reverse lever in full forward motion position and test the full travel. If there is a difference between the right and left sides of the engine, lengthen the gear reach rod on the side of the engine where the short travel exists. After obtaining the same travel on each side of the engine in this manner, the reverse lever should be put in its central position and the main reach rod adjusted until the dimensions shown on Fig. 6 are obtained for mid-gear position; then the quadrant length should be tested for the desired travel in both full forward and back motions.

Digitized by Google

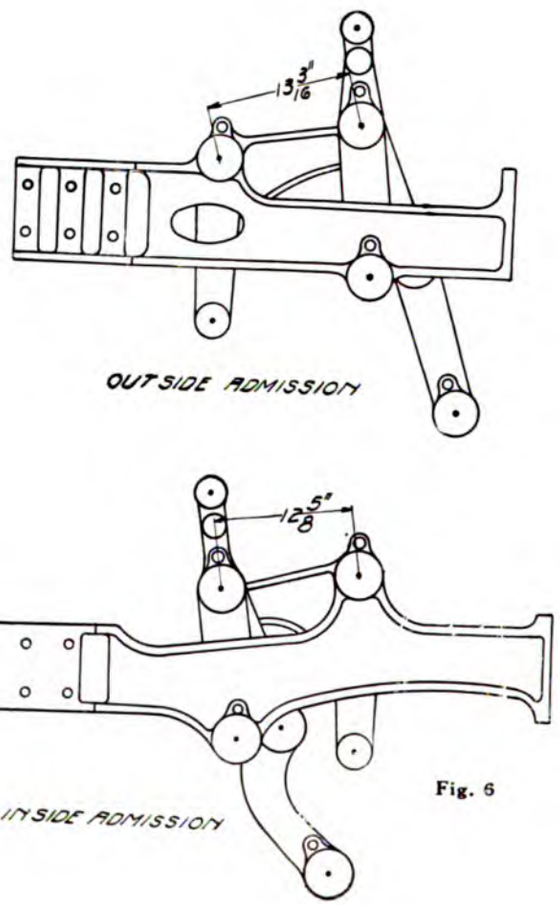


Fig. 6

Digitized by Google

Eccentric Rod Length—The inside admission gear is direct in the forward motion and indirect in the back motion and the ratio of the gear is 4 to 1, therefore the valve will move forward 1/16″ if the eccentric rod is lengthened ¼″ *with the lever in the extreme forward motion and the engine on dead center.* If the lever is in the extreme back motion the valve will move back 1/16″ when the rod is lengthened ¼″. Having taken the port marks with your standard valve stem tram, take the lead openings in both motions as shown by Fig. 7, which shows eccentric rod ¼″ too long for inside admission.

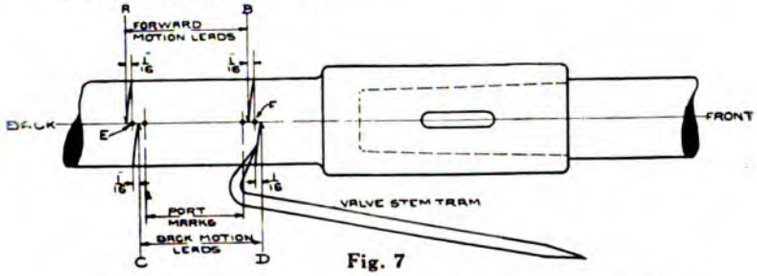


Fig. 7

If you shorten the rod ¼″ and take the lead points again the valve will be shifted back in the forward motion until lead line "A" is at "E" and lead line "B" is at "F," and in the back motion the valve will be shifted ahead until the lead line "C" will be at "E" and lead line "D" will be at "F," which will make the condition as shown by Fig. 8.

After obtaining leads as shown by Fig. 8, the length of the valve rod should be adjusted, making

Digitized by Google

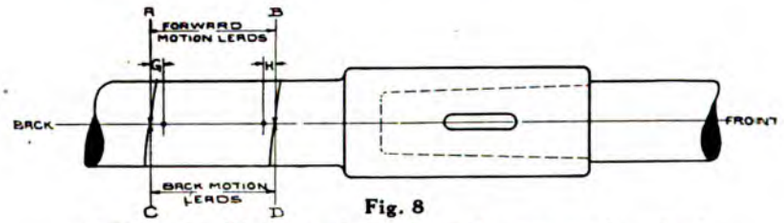


Fig. 8

"G" and "H" equal. After the setter has had some experience the valve rod and eccentric rod alterations can be made after one revolution of the wheels. Referring back to the paragraph on Eccentric Crank Setting, which can be checked from the stem (see Fig. 7), on which the distance between "A" and "B" on the horizontal line of the stem is equal to "C" and "D," this will always be the case when crank setting is correct, whether the eccentric rod shows long or short.

If the eccentric rod is 1/8" too short and the crank setting correct, the full gear lead lines will come as shown by Fig. 9.

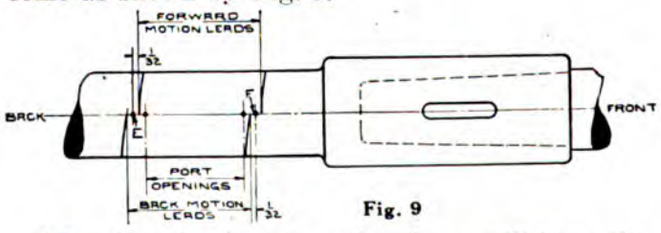


Fig. 9

After lengthening the rod 1/8" you will have the condition shown by Fig. 8.

The foregoing includes inside admission only and alterations in the eccentric rod length should be opposite for outside admission valves.

Digitized by Google

Valve Movements; General Information—The Baker Gear gets its motion from two points: the eccentric crank and the crosshead. The eccentric crank moves the radius bar and the action the radius bar has on the valve is controlled by the reverse yoke. The radius bar and the yoke take the place of the link and block of a link motion.

The crosshead moves the valve the amount of the lap and lead each way. This makes the lead constant and independent of the cut-off.

Having a constant lead, the valve should show lead opening in all cut-offs when engine is on either dead center.

Eccentric Crank Setting—With the Baker Gear the eccentric crank always follows the crank pin. It stands the same for both inside and outside admission.

Cut-off and Eccentric Rod—If the eccentric rod is off in length you can tell it by the following rule: If cut-offs are long on front end in forward motion and long on the back end in backward motion, the rod is too long. If the cut-offs come just the opposite of the foregoing then the rod is too short.

Break Downs—Two means are provided for blocking the gear and valve in case of a break down. The valve stem crosshead is provided with a set-screw so that the valve can be blocked central over the ports by clamping the valve stem crosshead to its guide. This is done in case the breakage on the gear or engine disables one side. (See Fig. 12.)

Digitized by Google

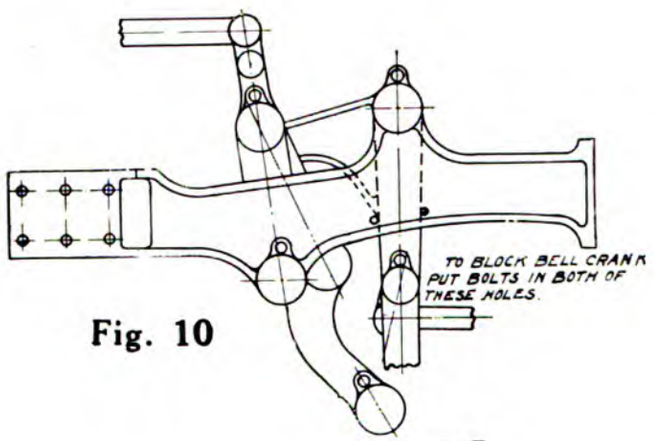


Fig. 10

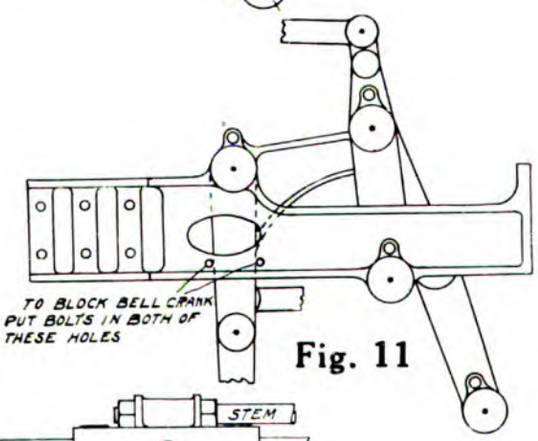


Fig. 11

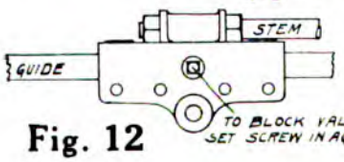


Fig. 12

Digitized by Google

The other way of blocking is by bolting the lower arm of the bell-crank fast to the side of the frame. After the valves have been set the reverse lever is put in mid-gear and two holes are drilled through the frame. Any bolt that will go through the hole can be used. (See Figs. 10 and 11.) With the gear bolted in this manner the valve will get the lap and lead movement and a port opening equal to the lead for all cut-offs. This allows the following parts to fail and yet get the lap and lead movement: eccentric crank, eccentric rod, connection rod, radius bars, reverse yoke, short reach rod and horizontal arm of bell-crank. In case the union link or crosshead arm fails, it will be necessary to block the valve over the ports, tie the combination lever fast, and disconnect the valve rod, unless the construction of the engine is such that the combination lever can be secured in practically a plumb position. If the combination lever can be fastened, the valve will get the eccentric movement. The port opening would be reduced and be closed in any cut-off shorter than 50 per cent.

In case the combination lever fails, close up the bell-crank, block the valve over the ports, disconnect the valve rod and tie the loose parts to keep them from doing damage.

In case of engine breakage do the same as with any other gear.

The Baker Valve Gear, like the Walschaert and other radial gears, readily lends itself to any change in design that may be necessary to suit the

Digitized by Google

construction of the locomotive to which it is applied.

The design shown in Fig. 1 is that originally adopted and common to the majority of locomotives fitted with this gear, especially those built in past years. On the later types of locomotives, however, especially the "Mikados," the design has been considerably modified, as for instance the long gear frame shown in Fig. 1, as extending back from the guide yoke to a bearing piece crossing the frames just ahead of the tumbling shaft, has been changed to a short cast steel bracket bolted to the rear of the guide yoke, this bracket carrying the bell crank and the reverse yoke. This change made it necessary to change the connecting point of the combination lever, and the combination lever was therefore, carried forward and connected to what is termed in a Baker Gear the valve rod, which corresponds to the radius rod in a Walschaert Gear, the connection being made at the valve stem crosshead. Where the valves are of the inside admission type, the valve stem is connected to the combination lever below the valve rod connection, and where the valves are of the outside admission type, the valve stem is connected to the combination lever above the valve rod connection, the connections being exactly the same as where the combination lever is placed as shown in Fig. 1.

The manner in which the valve stem is connected in the new type of gear and the valve rod is connected in the gear illustrated in this supple-

Digitized by Google

ment always indicates the type of valve used, that is, whether it is inside or outside admission.

In order that the action of this gear may be clearly understood with reference to the different types of valves used, we must first consider those with the gear illustrated as in Figs. 1, 3 and 4. The fulcrum point of the combination lever is its connection to the lower end of the bell crank, while on the later type of gear, the fulcrum point of the combination lever is where it is connected to the valve rod. In both instances this fulcrum is movable; in other words it does not occupy the same position at all points of the stroke. As explained in a previous portion of this supplement the combination lever gives the lap and lead travel; that is, it moves the valve so that it has traveled the amount of the lap and the lead at the beginning of each end of the stroke.

Referring to Fig. 3, as the combination lever obtains its movement from the crosshead, it is evident that when the crosshead is traveling forward carrying the lower end of the combination lever with it, the upper end of the combination lever must be traveling back, and the proportions of the combination lever are so arranged that when the crosshead is at its extreme forward position, the upper end of the combination lever has been pulled back the amount of the lap and the lead of the valve, thereby placing the valve in position to admit steam ahead of the piston to force the piston back. When the crosshead is at the other end of its travel, that is, at the back end of the guides,

Digitized by Google

the upper end of the combination lever would be moved forward the amount of the lap and the lead, thereby placing the valve in position to admit steam back of the piston. In the view shown, the valve rod makes a direct connection with the valve stem and consequently imparts to the valve the same movement, that is, a movement in the same direction as that imparted to the valve rod.

If, still referring to Fig. 3, the valves were of the inside admission type, and the valve rod connected as before, it is plain that with the crosshead at its extreme forward travel, which would throw the top end of the combination lever back, the back steam port would be open instead of the front one, consequently the engine would not move. For this reason where inside admission valves are used, the valve rod must be coupled below the fulcrum point as shown in Fig. 4, in order that when the crosshead is at the extreme forward end of its travel, the connection point of the valve rod will also be carried forward, thereby moving the valve forward and uncovering the front steam port.

With the later type of the Baker Gear, as previously explained, the forward end of the valve rod, which in this case corresponds with the radius rod of the Walschaert Gear, forms the fulcrum point of the combination lever same as the combination lever connection to the bell-crank as shown in Figs. 3 and 4; while the valve stem proper is connected direct to the combination lever, same as

Digitized by Google

the valve rod is connected in the figures mentioned. A study of this motion, therefore, shows that the first movement imparted to the valve is that given by the crosshead through the combination lever, the remainder of the movement being imparted by the eccentric crank through the bell-crank. To make this clear imagine in Fig. 3, which shows the reverse lever in forward gear, that the reach rod was pulled back so the reverse lever would occupy the center of the quadrant; this would then throw the reverse yoke connections in line with the bell-crank connection and the only effect that the eccentric crank would have, would be to oscillate the radius bars forward and back without imparting any material movement to the bell-crank, and as the valve obtains its movement from the movement of the bell-crank and the combination lever, it is clear that the only material movement imparted to the valve under these conditions, would be that given by the combination lever, which would be equal to twice the lap and twice the lead.

Throwing the reverse lever into forward gear, places the radius bars in an angular position and therefore they can not oscillate as before without raising up and down; as they are so connected, however, as to prevent any up and down movement, it follows that the movement of the eccentric crank instead of being imparted to the radius bars only, in this instance would be imparted to the bell-crank, causing the forward end of the bell-crank in Fig. 3, and the back end in Fig. 4, to move up and down. This would cause the lower

Digitized by Google

end of the bell-crank to move forward and back, thereby imparting additional motion to the valve through the valve rod.

This explanation is deemed necessary in order that engineers will clearly understand the different movements, so that in case of failure of any one of the parts of this gear, they would know how to disconnect, what to disconnect and how to block the remaining portion of the gear to get a valve travel on the disabled side. On the later type of Baker Gear there is practically nothing that could break which would prevent obtaining some valve travel, with the exception of a valve stem. On the type of gear herein illustrated there is practically nothing that could break which would prevent obtaining a valve travel with the exception of the valve stem, valve rod or lower end of bell-crank.

Break Downs—Beginning at the rear end; in case the eccentric crank, eccentric rod, or the lower end of the gear connecting rod should break, the only movement that could be imparted to the valve would be that of the combination lever, and as the combination lever is fulcrumed to the bell-crank, it is plain that the bell-crank must first be secured in a rigid position so that all the movement imparted by the crosshead to the combination lever would be imparted to the valve, as otherwise were the bell-crank not secured, the chances are the bell-crank would move instead of the valve rod. On the type of gear herein illustrated you will notice two holes through the gear

Digitized by Google

frame, Figs. 10 and 11; these holes are for the purpose of fastening the bell-crank in case of failure of any of the parts previously mentioned, the bell-crank being secured to the gear frame by means of a U-bolt placed in these holes.

The short reach rod connecting the reverse or tumbling shaft arm to the reverse yoke should also be disconnected at one end and the reverse yoke thrown forward against the gear frame in order to get it out of the way. This would then give you the full valve travel on the good side of the locomotive but only a travel equal to the lap and the lead on the disabled side and a port opening on the disabled side equal to the lead opening.

With an engine disconnected in this manner, you should be careful not to stop with the good side on the dead center as if the good side is on the dead center, the disabled side would necessarily be on the quarter and in this case the combination lever would be straight up and down, and the ports covered on the disabled side, making this side powerless, and as the good side of the engine would be on the dead center, that side would naturally be powerless also and the engine would not move. Should you happen to stop in this position, however, the engine could be gotten off the center on the good side without the necessity of pinching by disconnecting the lower end of the combination lever from the union link, and moving the combination lever in the right direction to uncover the port that would allow the engine to move in the direction desired, as for

Digitized by Google

instance, if the engine stopped with the good side on the forward dead center with the other side on the upper quarter, and it was desired to move in a forward direction, the combination lever should be swung so as to uncover the back steam port on the disabled side. After the engine had been moved off the dead center on the good side, the combination lever should be coupled up again.

With the new type of gear there are no holes provided in the gear frame for the purpose of fastening the bell-crank, but the bracket is so cast that wooden wedges can be driven on either side of the bell-crank to hold it in position.

If the gear connection rod should break below the pin where it is fastened to the gear frame, it would of course be necessary to disconnect the eccentric rod, then block same as for broken eccentric rod or crank. If the gear connection rod should break above the pin, the eccentric rod could be left up, proceeding with the balance of the operation same as for broken eccentric rod, etc.

In case the union link or the combination lever should break, two methods could be employed: First, with the gear illustrated, the combination lever together with the union link could be removed and in many instances the valve rod could be connected direct to the bell-crank at the point where the combination lever was formerly connected. If this could not be done and the failure was of the union link or of the combination lever at a point below its connection with the bell-crank,

Digitized by Google

the union link, if broken, should be removed, or the union link and that portion of the broken combination lever should be removed, the remaining part of the combination lever placed so it would hang straight down and then either wedged or clamped in such a position that it could not move on its fulcrum point on the bell-crank. This would then allow the eccentric crank to impart a motion to the valve equal to the difference between the motion imparted by the eccentric crank only and that imparted by the combined movements of the eccentric crank and the combination lever. The port openings would naturally be reduced and it would be necessary to work the engine in practically full stroke in order to get any opening on the disabled side. With an engine disconnected in this manner no port opening would be obtained on the disabled side at the beginning of the stroke.

With the type of gear herein illustrated, in case of failure of the valve rod, the engine would naturally be disabled on that side; it would not be necessary to disconnect anything however; simply remove the broken parts if they are liable to interfere, clamp the valve central on its seat and make the usual provision for lubricating the cylinder. This can be done by either taking out cylinder relief valves, in case the cylinder is provided with them or slacking off on the front cylinder head. With the newer type of gear, however, even in case of a failure of the valve rod you could still obtain a port opening and work steam

Digitized by Google

on the disabled side by first removing the engine so that the crosshead on the disabled side would be at the center of its stroke, that is, with that side on the quarter, then disconnect the disabled valve rod and cut a piece of plank long enough to reach from the back end of the steam chest to the guide yoke; cut a notch through this plank that will fit over the upper end of the combination lever; fasten it securely in place. This will act as a fulcrum point for the combination lever and give you the lap and lead travel. There would be no need of disconnecting any other portions of the gear.

Digitized by Google

QUESTIONS AND ANSWERS

Q.—What type of gear is the Baker valve gear and is it of the direct or indirect motion?

A.—It is of the radial type; outside gear, direct going ahead for inside admission valve and indirect backing up; indirect going ahead for an outside admission valve and direct backing up.

Q.—In what does the Baker gear differ from the Walschaert?

A.—In the manner in which the cut-off is regulated and the engine reversed.

Q.—How is this accomplished in the Baker gear?

A.—By means of a reverse yoke instead of a link.

Q.—Through what parts does the valve obtain its movement with the Baker gear?

A.—Through the combination lever from the crosshead and through the eccentric crank connected to the main crank pin.

Q.—What movement is imparted to the valve by means of the combination lever?

A.—That necessary to overcome the lap of the valve and give the lead desired.

Q.—Is the lead given by the Baker valve gear constant or variable?

A.—It is constant.

Q.—What do you understand by pre-admission?

A.—It is the act of admitting steam or having a port open before the piston reaches the end of its stroke.

Q.—With the Baker gear is the pre-admission constant same as the lead?

A.—No; pre-admission is variable, increasing as the cut-off is shortened.

Q.—What would be the effect of pre-admission with an engine in full gear?

A.—It would have a tendency to retard the movement of the engine; also in a measure decrease its starting power.

Q.—Does this same objection obtain when an engine is worked in a short cut-off?

A.—No; pre-admission in this case acts as a cushion for the reciprocating parts.

Q.—How can you tell at a glance whether an engine equipped with a Baker gear has an inside or outside admission valve?

A.—By the manner in which the valve rod is connected to the combination lever; an engine having an inside admission valve has the valve rod connected below the point at which the combination lever is attached to the bell crank, and one having outside admission valves has the valve rod connected above this point.

Q.—Is there any difference in the setting of the eccentric crank for the inside and outside admission valve?

A.—No; the eccentric crank always follows the main pin.

Q.—How should the different bearings of the Baker gear be

Digitized by Google

lubricated? What kind of oil should be used?

A.—Bearings should be lubricated by filling the pockets or cavities cast in all the movable parts and connecting with the bearings; these pockets should preferably be kept full of curled hair in order to assist in retaining the oil and to prevent grit and other abrasives getting into the bearings. Engine oil only should be used.

Q.—Why not use valve oil in lubricating these bearings?

A.—Because owing to the limited movement of the bearings there is no tendency on their part to run hot, and valve oil being thicker than engine oil would not flow around the bearings as readily and consequently might cause the bearings to seize.

Q.—What would you do in case of failure of the eccentric crank, eccentric rod, or lower end of gear connection rod?

A.—Disconnect broken parts and remove such portions as are liable to interfere; disconnect the short reach rod; fasten the bell-crank in its central position and proceed on both sides.

Q.—With an engine disconnected in this manner, what port opening would you get on the disabled side?

A.—A port opening equal to the lead.

Q.—With an engine disconnected in this manner what precautions should be taken in stopping?

A.—To see that the engine did not stop with the good side on the dead center.

Q.—Why is this precaution necessary?

A.—Because in this case, the good side being on the center would be powerless, and the disabled side being on the quarter would place the valve in its central position covering both ports, consequently no steam would be admitted to the cylinder on the disabled side and the engine would not move.

Q.—In case an engine disconnected in this manner, did stop with the good side on the dead center, could the engine be moved without pinching? If so, how?

A.—Yes; by disconnecting the lower end of the combination lever and moving the valve so as to obtain a port opening.

Q.—With an engine disconnected in this manner and the disabled side on the quarter, why could not a port opening be obtained by placing the reverse lever at full gear either forward or back?

A.—Because in the first place the reach rod is disconnected on that side and in the second place, if the reach rod were not disconnected, the reverse lever would have no influence on the valve movement as the only movement given to the valve would be that imparted by the crosshead.

Q.—What should be done in case the gear connection rod broke above the point where it was fulcrumed to the gear frame?

A.—Proceed same as for a broken eccentric rod or crank, except in this case it will not be necessary to disconnect the eccentric rod.

Q.—What should be done in case of a broken radius bar?

A.—Handle same as for broken eccentric rod or crank.

Q.—What should be done if the upper or horizontal bell crank arm should break?

Digitized by Google

A.—Handle same as for broken eccentric rod.

Q.—What should be done in case the lower or vertical arm of the bell crank broke?

A.—With the type of gear here illustrated this failure would totally disable the engine on that side. All that would be necessary to disconnect however would be the combination lever, union link and valve rod; then clamp the valve to cover the ports and make the usual provision for lubricating the cylinder. With the later type of gear, disconnect the valve rod, then fasten the top of the combination lever by means of a plank extending from the steam chest to the guide yoke.

Q.—What would you do in case you broke the crosshead arm, union link or lower portion of the combination lever?

A.—Remove the broken parts that are liable to interfere. If in case of a broken union link or crosshead arm, the combination lever can be fastened so that it cannot move, do this and proceed with a full train. If the combination lever is broken near its connection however, or cannot be fastened, connect the valve rod direct to the bell crank in place of the combination lever if possible; if not, wedge or clamp the upper end the combination lever to the bell crank in such a manner that it cannot move and proceed with a full train.

Q.—With an engine disconnected in this manner, how much valve travel will be obtained on the disabled side?

A.—About two-thirds of the usual travel.

Q.—With an engine disconnected in this manner at what cut-off should the engine be worked to secure any power on the disabled side?

A.—The engine should be worked at practically full stroke, if cut back to less than half stroke no port opening would be obtained on the defective side.

Q.—What do you do in case of a broken valve rod?

A.—Where the valve rod is connected from the combination lever direct to the valve stem crosshead, the engine would be disabled on that side and should be handled accordingly. There would be no need to disconnect anything however except the valve rod. Where the valve rod forms a connection between the bell crank and the combination lever, and the combination lever is attached to the valve stem crosshead, a lead opening could be obtained by fastening the top of the combination lever.

Q.—What would you do in case of a broken reverse yoke?

A.—In case the yoke is broken at the short reach rod connection, take down the short reach rod and block the yoke securely at the cut-off in which it is necessary to work the engine. If the break in the reverse yoke is below the suspension point or lugs, proceed the same as with broken eccentric rod or eccentric crank.

Q.—What would you do in case of a broken reach rod?

A.—If one of the short reach rods, block the yoke at the desired cut-off point; if the main reach rod, block between tumbling shaft arm and cross brace.

Digitized by Google

b89090508417

b89090508417a

ience of Railways

...enience of those interested particularly in certain lines of work, Kirkman's "Science of Railways" is divided and sold in groups, as follows:

Special prices for these groups, and for the complete set, are made to railway employes, and payment may be made on the monthly installment plan if desired. The books are bound in half leather, and are a handsome addition to any library.

Group A, MOTIVE POWER DEPT.
- Locomotive and Motive Power Department.
- Engineers' and Firemen's Handbook.
- Locomotive Appliances.
- Electricity Applied to Railways.
- Air Brake—Construction and Working.
- Operating Trains.
- Portfolio of Locomotives.
- Portfolio of Air Brake—Westinghouse.
- Portfolio of Air Brake—New York.

Group B, AGENTS AND OPERATORS.
- Passenger Traffic and Accounts.
- Freight Traffic and Accounts.
- Collection of Revenue.
- Electricity Applied to Railways.
- Operating Trains.
- Portfolio of Locomotives.
- Portfolio of Air Brake—Westinghouse.
- Portfolio of Air Brake—New York.

Group C, OFFICES AND STATIONS.
- Organization of Railways—Financing.
- Passenger Traffic and Accounts.
- Freight Traffic and Accounts.
- Safeguarding Railway Expenditures.
- General Accounts and Cash.
- Collection of Revenue.
- Railway Rates and Government Ownership.
- Electricity Applied to Railways.
- Operating Trains.
- Portfolio of Locomotives.
- Portfolio of Air Brake—Westinghouse.
- Portfolio of Air Brake—New York.

Group D, ROADWAY AND TRACK.
- Building and Repairing Railways.
- Safeguarding Railway Expenditures.
- Portfolio of Locomotives.

Group E, CAR SHOPS.
- Cars—Construction, Handling and Supervision.
- Air Brake—Construction and Working.
- Portfolio of Cars.
- Portfolio of Air Brake—Westinghouse.
- Portfolfo of Air Brake—New York.

Group F, LOCOMOTIVE SHOPS.
- Locomotive Appliances.
- Shops and Shop Practice, Vol I.
- Shops and Shop Practice, Vol. II.
- Air Brake—Construction and Working.
- Portfolio of Locomotives.
- Portfolio of Air Brake—Westinghouse.
- Portfolio of Air Brake—New York.

Group G, ROUNDHOUSE.
- Shops and Shop Practice, Vol. I.
- Shops and Shop Practice, Vol. II.
- Portfolio of Locomotives.
- Portfolio of Air Brake—Westinghouse.
- Portfolio of Air Brake—New York.

Group H, TRAINMEN.
- Operating Trains.
- Cars—Construction, Handling and Supervision.
- Air Brake—Construction and Working.
- Portfolio of Cars.
- Portfolio of Air Brake—Westinghouse.
- Portfolio of Air Brake—New York.

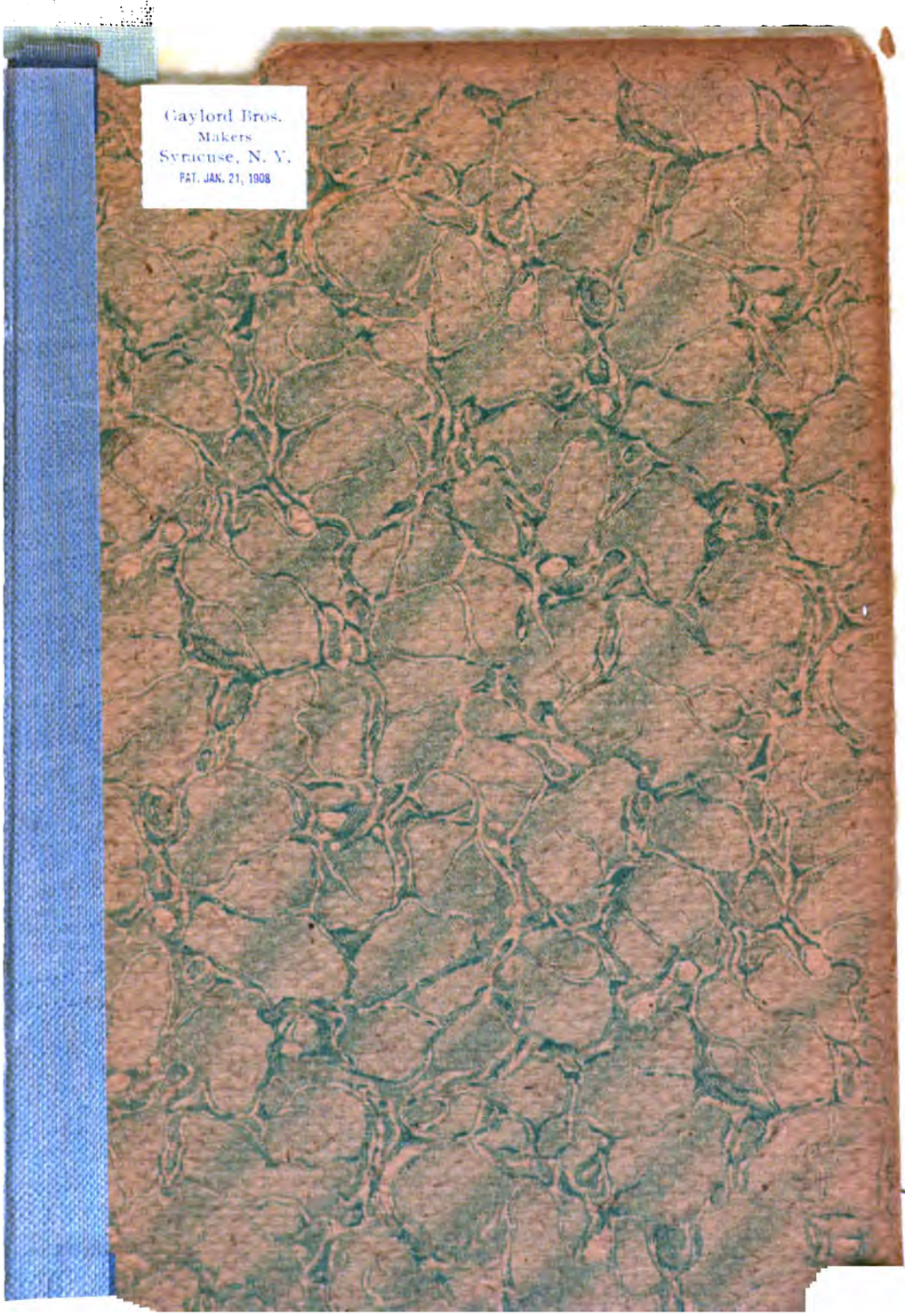
Group I, Full Set.
- Locomotive and Motive Power Department.
- Engineers' and Firemen's Handbook.
- Locomotive Appliances.
- Electricity Applied to Railways.
- Cars—Construction, Handling and Supervision.
- Air Brake—Construction and Working.
- Operating Trains.
- Collection of Revenue.
- Building and Repairing Railways.
- Organization of Railways—Financing.
- Passenger Traffic and Accounts.
- Freight Traffic and Accounts.
- Safeguarding Railway Expenditures.
- General Accounts and Cash.
- Railway Rates and Government Ownership.
- Shops and Shop Practice, Vol. I.
- Shops and Shop Practice, Vol. II.
- Portfolio of Locomotives.
- Portfolio of Cars.
- Portfolio of Air Brake—Westinghouse.
- Portfolio of Air Brake—New York.

Full information furnished on request.

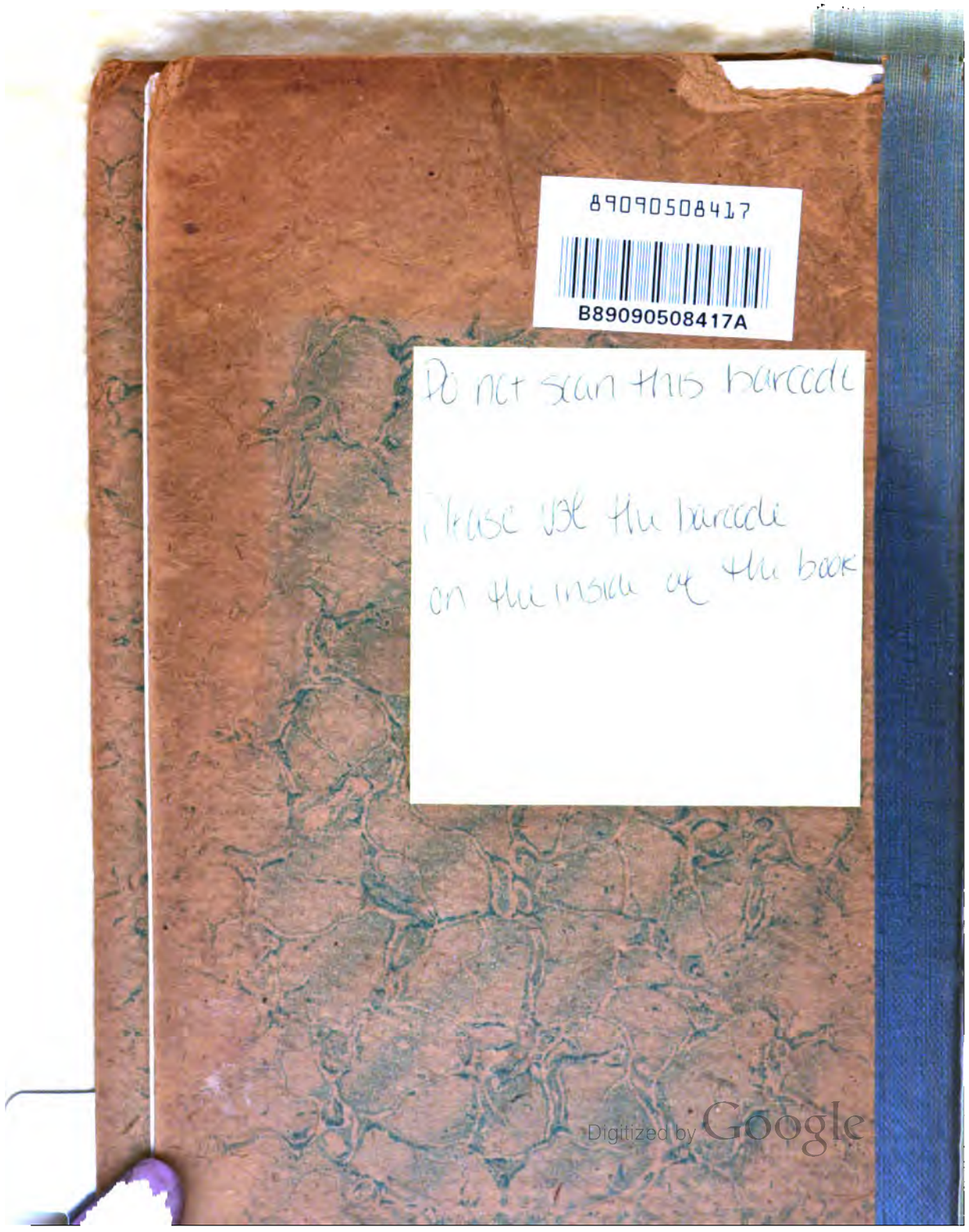
CROPLEY PHILLIPS COMPANY, Publishers

TRIBUNE BUILDING, CHICAGO

Digitized by Google



Digitized by Google


B89090508417
B89090508417A
Do not scan this barcode
Please use the barcode on the inside of the book
Digitized by Google